

MEASUREMENT OF GAS AND VOLATILE ELEMENTS PRODUCTION CROSS SECTIONS IN A MOLTEN LEAD-BISMUTH TARGET

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MEGAPIE is a project for a 1 MW liquid PbBi spallation source, to be built at the SINQ facility at the Paul Scherrer Institut, which will be an important step in the roadmap towards the demonstration of the ADS concept and high power molten metal targets in general. For a reliable and safe operation of the experiment, it is extremely important to evaluate the amount and type of gas and volatile elements which will be produced. Both stable (H, ⁴He and other noble gases) and radioactive isotopes (including Kr, I, Hg and Po isotopes) are of interest. Different design options are under consideration to deal with the gas produced during operation.

For a correct estimate of the production cross sections, a measurement with a liquid PbBi target and a proton beam of energy close to the one of MEGAPIE (575 MeV) is necessary. Such a measurement was performed at the ISOLDE facility at CERN, which offers the unique opportunity via its mass spectrometric analysis of the elements present in the gas phase above the target to measure the production rate of several volatile elements produced in a liquid PbBi sample, after interaction of a proton beam with energy of 0.6, 1 or 1.4 GeV. Measurement techniques include detection with a Faraday cup, on-line γ counting with the ISOLDE monitoring tape station, and collection on a foil and off-line α -, β - and γ -spectroscopy. From the obtained yields, cross sections were deduced taking into account the ion source efficiency and other known correction factors.

The results from the measurements and from Monte Carlo simulations of the experiment, and their impact on the design of MEGAPIE will be discussed.